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THE TEA QUARTERLY

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THE TEA RESEARCH INSTITUTE,
St. Coombs, Talawakelle,
Ceylon.

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Publications.—The *Tea Quarterly* and *Bulletin* published by the Tea Research Institute will be sent free of charge, to Superintendents of Ceylon tea estates, over 10 acres in extent, and to estate Agencies dealing with Ceylon tea, if they register their names with the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle.

Other persons can obtain the publications of the Institute on application to the Director, the subscription being Rupees fifteen per annum for persons resident in Ceylon or India, and £ 1–5–0 for those resident elsewhere. Single members of *The Tea Quarterly* can be obtained for Rs. 2–50 or 4*s*. In the case of Indian cheques four annas should be added to cover commission.

THE TEA QUARTERLY

VOLUME XXIV DECEMBER, 1953 PART IV

POTASH DEFICIENCY IN TEA

G. B. Portsmouth

Apart from the intrinsic interest of the following article, it is especially notable by reason of the fact that it includes the first colour plates used to illustrate an article in this journal. The advantages of coloured illustrations, especially for pathological subjects, are manifold and it is hoped that the high cost of colour plates will not prohibit their use, to a limited extent, in future publications. On this occasion, the whole cost of the colour plates has been borne by Kalivertriebsstelle G.M.B.H. of Hannover and we are greatly indebted to them for this generous contribution as well as to their representative, Dr. Piekenbrock, who took the original photographs.

The analytical data used in the article were culled from an extensive series of leaf analyses planned by Dr. Haworth during his period of service as Agricultural Chemist. The use of the data has been delayed and complicated by Dr. Haworth's resignation, but their usefulness is clearly demonstrated by Mr. Portsmouth's interpretation.

In 1950 I published an article in this journal dealing with the potash requirements of tea[1]. In this article I briefly reviewed the results of the main St. Coombs three factor manurial experiment, in so far as they related to potash, up to the end of the sixth cycle in 1949. By that time the responses, in terms of yield per pound of applied fertiliser, to potash manuring had already reached similar levels to those given by nitrogen manuring. Now, at the end of the seventh cycle of this experiment, the potash responses are greatly in excess of the nitrogen responses, as can be seen from the respective yield figures given in Tables 1 and 2.

Table 1. *St. Coombs Manurial Experiment. Dry Matter Yields for Potash Treatments (Lbs. per acre).*

Cycle years	Treatment	1st year		2nd year		3rd year		Cycle	
		Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
1949-52 Cycle 7	K_0	226		682		571		1479	
	K_{20}	299	+ 73	884	+ 202	712	+ 141	1895	+ 416
	K_{40}	306	+ 80	909	+ 227	761	+ 190	1976	+ 497

Table 2. *St Coombs Manurial Experiment. Dry Matter Yields for Nitrogen Treatments. (Lbs. per acre).*

Cycle years	Treatments	1st year		2nd year		3rd year		Cycle	
		Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
1949-52 Cycle 7	N_{40}	264		759		573		1596	
	N_{60}	276	+ 12	812	+ 53	675	+ 102	1763	+ 167
	N_{80}	291	+ 27	904	+ 145	796	+ 223	1991	+ 395

Considering only the first increment of 20 lbs. fertiliser per acre, it will be seen that, over the three year cycle, the potash response is 416 lbs. of made tea and the equivalent nitrogen response 167 lbs. made tea. This represents a return of 6.9 lbs. of made tea for each pound of potash applied, compared with a return of only 2.8 lbs. for each pound of nitrogen applied.

At the higher treatment levels the difference in response is rather less marked, indicating that a further increase in the potash response at the K_{40} level may still be expected in the future. Whether or not further response increases do occur, it is abundantly clear that potash has now taken over the position, once held by nitrogen, of being the dominant fertiliser treatment in the experiment.

In my previous article I made the point that the increase in yield brought about by potash manuring may also be taken to represent the loss in crop resulting from an absence of potash in the manure. From this view point it is obvious, from Table 1, that lack of potash has resulted in a loss of crop of some 497 lbs. per acre over the cycle, which represent a reduction in yield by 25 per cent.

That the plots, which have received no potash for over 22 years, are now suffering severely from this cause is evident from the marked increase in potash deficiency symptoms which have become apparent during the last two cycles. The present extent and effects of potash deficiency in these K_0 plots are well brought out in the accompanying coloured plates, which have been very kindly presented to the *Tea Quarterly* by the German potash organisation, Kalivertriebsstelle G.M.B.H. of Hannover. These plates were printed in Germany from photographs taken by Dr. A. P. Piekenbrock, of Kalivertriebsstelle G.M.B.H., when he visited St. Coombs in August 1951. Dr. Piekenbrock was greatly impressed by what he saw and felt that these striking effects of potash deficiency in tea were worthy of first class reproduction in colour. To Dr. Piekenbrock's enthusiasm and Kalivertriebsstelle's generosity the *Tea Quarterly* therefore owes its first set of plates in full colour.

The effects of potash deficiency illustrated are briefly as follows:—

(1) Many vacancies, due to deaths of badly potash deficient bushes following recent prunes.

(2) Continued shedding of the lower leaves, resulting in bushes which carry only a few leaves at the top of each branch. Bushes of this general type can be clearly seen in the first and fourth picture.

(3) Thin twiggy wood.

(4) Almost complete absence of any new flush growth.

(5) Pronounced marginal scorch on many of the leaves still remaining on the bushes, as can be clearly seen in the second, fifth and sixth pictures. This is probably a completely diagnostic symptom of potash deficiency in tea, but is not often seen as the leaves are usually shed before it appears.

That these effects are, in fact, due to lack of potash is confirmed by the results of a series of leaf analyses recently carried out by the Agricultural Chemistry Department. Two bushes in each plot of the experiment were allowed to rest from the end of October 1951. After 7 months resting, these bushes were cut across at the old plucking level, at the end of May 1952, and the pruned shoots divided into leaves and stems. It should be noted that these leaf samples contained leaves up to 7 months old and thus do not correspond with the plucked flush samples, for which potash analyses have been given previously. However, for convenience, they will be designated New Leaf Samples. At the same time as these samples were taken,

Left NP, right NPK mixture: note effect of lack of potash in manure mixture, many vacancies; also lack of maintenance foliage on the surviving bushes

Typical bush on the no potash plot: Note the general debilitated appearance of the bush; thin branches, poor foliage

Fully supplied with potash: Note that the bushes cover the ground completely. Adequate foliage, no vacancies

No potash plot: Note thin wood and poor foliage on surviving bushes; many bushes have died

Shoot from bush on the no potash plot showing marginal scorch on mature leaves

Leaf from typical debilitated bush showing pronounced marginal scorch

THESE TWO STUBS ARE PROVIDED FOR USE WHEN MOUNTING

a sample consisting of 50 old maintenance leaves, was collected from below the cut-across level from each bush. These samples consisted entirely of comparatively old foliage and will, therefore, be designated Old Leaf Samples.

After oven drying all these leaf samples were finely ground and analysed individually for potash, calcium, magnesium and phosphoric acid. The collected results of these analyses, expressed as percentages of the dry weight, are given in Table 3 and 4.

Table 3. *St. Coombs Manurial Experiment. Chemical analysis of New Leaf Samples. (Results expressed as percentages of the dry weight.)*

Treatment level	K_0	K_{20}	K_{40}	Mean
Potash as K_2O	0.73	1.10	1.35	1.06
Calcium as CaO	2.47	2.27	1.97	2.24
Magnesium as MgO	0.63	0.45	0.44	0.51
Total (K_2O + CaO + MgO)	3.83	3.82	3.76	3.80
Phosphoric acid as P_2O_5	0.40	0.41	0.40	0.40

Table 4. *St. Coombs Manurial Experiment. Chemical analysis of Old Leaf Samples (Results expressed as percentages of the dry weight)*

Treatment level	K_0	K_{20}	K_{40}	Mean
Potash as K_2O	0.58	1.14	1.50	1.07
Calcium as CaO	3.07	2.98	2.52	2.86
Magnesium as MgO	0.76	0.50	0.46	0.57
Total (K_2O + CaO + MgO)	4.41	4.62	4.48	4.50
Phosphoric acid as P_2O_5	0.36	0.34	0.34	0.35

From the figures it is obvious that the potash content of the leaf is completely dependent on the amount of potash applied as fertiliser. In the new leaf series the potash content of the leaves from the K_0 plots is only about half that of the leaves from the K_{40} plots. In the old leaf series the range of potash contents is even wider, since the leaves from the K_0 plots show little more than one third of the amount of potash found in the leaves from the K_{40} plots. In the face of this very strong chemical evidence there can be little doubt remaining that the effects observed in the K_0 plots are entirely due to true potash deficiency.

It is worth noting that in both series of samples the total content of potash, calcium and magnesium is approximately constant. This means that where potash is in short supply the deficit is made up by means of an increased uptake of calcium and magnesium, with the result that the salt content of the bush is kept the same. However, it is obvious, from the yield figures and the marked symptoms developed as a result of potash deficiency, that neither calcium nor magnesium is capable of replacing potassium in the many physiological functions it fulfils within the bush.

The constancy of the phosphoric acid contents, given in the bottom lines of Tables 3 and 4, indicates the absence of any form of interaction between potash and phosphoric acid uptakes.

In conclusion I should like to express my thanks to Dr. F. Haworth for initiating this very extensive system of leaf sampling and chemical analysis.

REFERENCE

(1) Portsmouth, G.B.—Potash Requirements of Tea. *Tea Quarterly*, XXI, Pt. 1, p. 18, March, 1950.

VEGETATIVE PROPAGATION OF TEA—THE MANUFACTURING ASPECT

E. L. Keegel

The economic possibilities of replanting tea with selected high yielders by means of vegetative propagation are now being appreciated by more and more estates. Yield and other physiological characteristics of a bush are not necessarily the only things to be considered; the quality of the manufactured product is equally important.

The extent to which quality can vary among individual bushes has perhaps not been fully realized. Considerable differences exist even amongst plants of similar morphological characters. Examination of hundreds of plants at the Institute has not shown any clearly definite relationship between quality and leaf type. Generally speaking, however, the small leaf varieties have been found to give good quality, but on account of their low potential yield vegetative propagation is now confined to the larger leaf types. These have given vastly different teas, ranging from common low grown tea to quality that would under normal conditions compare favourably with teas produced in the Nuwara Eliya district.

It will be a grave mistake, therefore, to take no notice of the characteristics of the manufactured product in the process of selection. Testing for quality should, in fact, be done simultaneously with observations in the field. Periodical tests will soon reveal the undesirable types. The worst quality bushes are rejected and on the clones propagated from those selected for their desirable characteristics further manufacturing tests will have to be carried out to confirm the results previously obtained.

Of the numerous bushes and clones tested at the Institute, it was noted that, without exception, all the intrinsic manufacturing characters were transmitted from the mother bush to the progeny. It may be that if grown at a different elevation, a clone would not have the identical characteristics of the parent bush. There is insufficient evidence on this point. Selected bushes from low country estates have always given very strong and coloury teas, but never the quality of an up-country tea. Whether the characteristic quality associated with growth at the higher elevations could be obtained at lower levels by propagation of specially selected plants from up-country areas, it is difficult to say as yet.

If it is to be established that any promising characteristic is not the result of some external factor such as age from pruning, season or soil or environment, a systematic study is obviously essential. Wrong conclusions might be easily drawn from sporadic tests.

The Institute has from time to time assisted many estates in manufacturing leaf from individual bushes but such isolated tests can serve very little purpose if they are not followed by a series of manufactures. Estates should experience no difficulty in carrying out their own quality tests and it is hoped that what follows in this article will enable them to do so and to interpret results as accurately as possible.

In the testing of individual characteristics of different bushes the most important point to remember is that, no matter what tea-making equipment is employed for

the purpose, the technique developed must give consistent results. This is an essential prerequisite which, if ignored, makes quality tests a farce. The use of a pestle and mortar or a rolling pin or any other makeshift arrangement to bruise the leaf may be all very well for rough and ready tests but such methods cannot be recommended in selection work. Too much is left to chance in an investigation which by its very nature depends on its success for the estimation of a value of a tea on a strictly comparable basis.

The method devised at the Institute was tested by carrying out a number of successive manufactures of flush from pairs of different bushes. Results were consistent over a long period, the same differences of characteristics inherent in the bushes being always recognised by a tea-taster. Although normal teas were not produced —an impracticability with only a few shoots—the method of manufacture on such a miniature scale was standardized accurately enough to assess small differences in the more important characteristics of a tea liquor.

In brief, the method adopted was to bruise withered leaf in a hand operated, small scale Clivemeare roller set at a fixed pressure. The leaf was then minced in an ordinary mincing machine, sifted over a hand sieve, fermented and fired. The teas so produced were generally strong and harsh, having a certain brassy coarseness and the leaf itself was abnormally brown and flaky as a result of the severe treatment. Since the quality factor is the most important these peculiar features do not matter but it should be mentioned that despite the extra colour and strength induced by this technique, variations in these two characters due to intrinsic properties of different bushes were noted. As these two factors may assume considerable importance under normal methods of manufacture they cannot be left out in selection work. Consequently, some allowance must be made when assessing colour and strength in teas produced from an abnormal system of manufacture and if a true discount is to be made a *standard* method of manufacture must be employed. The method must leave no room for doubt that the observed differences are due to inherent characteristics.

The technique adopted at the Institute, which involves the use of the Clivemeare roller, may not be found acceptable to most estates. The use of a mincing machine alone, however, should present no difficulties. In fact, the omission of clivemearing is in some ways preferable since the tea taster's job is made easier as a result of the teas possessing less strength which, if too prominent, can obscure quality.

The ordinary household mincing machine is available in different sizes and it is recommended that the smallest be used for individual bush manufacture. It is provided with different types of cutters, the selection of which for the work in hand must be made with care. Too coarse a cutter results in insufficient bruising of the leaf. If it is too fine the leaf is reduced to pulp, and a certain amount of cell sap is also lost. A few preliminary experiments will reveal the most suitable cutter which would bring out the best characteristics of the leaf. The cutter of one's choice should of course not be changed under any circumstances. It is necessary to take two more precautions. One is to have the machine and all its parts chromium plated and the other to observe scrupulous cleanliness.

For inexact tests, chiefly with a view to rejecting poor fermenters, withering is not necessary. Some idea of the fermenting properties of a bush may be formed by mincing the green leaf but it is inadvisable to rely entirely on such findings for two reasons. In the first place, although leaf may appear to ferment well the actual infusion after brewing can be greenish and secondly, quality does not bear the same close relationship to colour of infusion as is generally the case with normally manufactured teas. Many instances have been noted where greenish infusions have been associated with excellent liquors as coloury and pungent as those combined with bright, reddish infusions. That this was not accidental was proved by repeated manufactures. To discard shy fermenters, therefore, without a proper quality test is most certainly unwise.

The method for quality tests of leaf from individual bushes, which is recommended for estates, is as follows:—

Withering:—No special precautions are necessary but to facilitate the work it is suggested that small tats of hessian be used. Each tat must be mounted on a wooden frame, 24″ × 18″, supported on short legs. Such an arrangement will ensure easier control of the withering process since the leaf can be taken to any part of the factory. When hot air is not required and there is a danger of the leaf being overwithered the tats could be placed in the coolest section of the factory, namely, the rolling room. They will be found most serviceable in exceptionally dry weather. At such times a good natural wither can be obtained by just keeping the leaf in the rolling room.

Too hard or too soft a wither is not suitable for individual bush manufacture and with a little practice the correct wither could be obtained by varying the rate of spread during withering. In the later stages when it is desired to check the wither, standing the trays on a wetted floor proves helpful.

Bruising (Rolling):—The equipment needed should consist of the following:—

(1) A mincing machine. (Chromium plated).

(2) A hand sieve (not more than 16″ in width and 1″ in depth) fitted with No. 10 brass mesh or preferably, stamped aluminium with 2 mm perforations.

(3) A spatula made of thick aluminium about 2½″ by 1½″, for rubbing the minced leaf over the mesh.

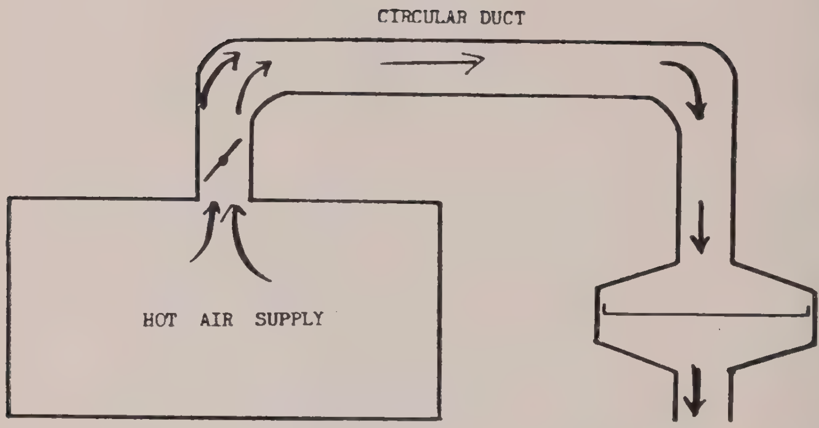
(4) A sheet of stainless steel or aluminium, about 2 feet square, for collecting the dhool.

For normal routine examination of a few samples, duplication of this equipment should be more than sufficient.

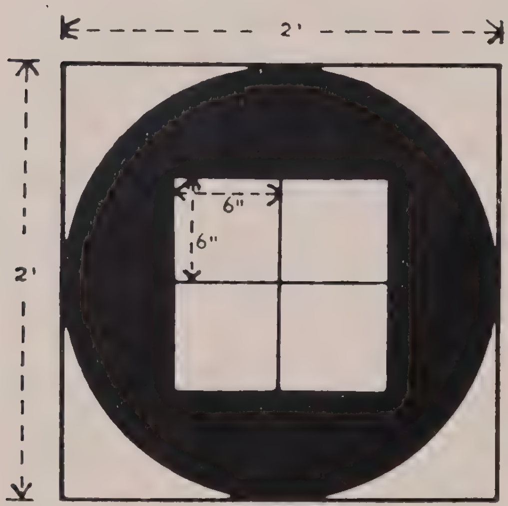
Since great care must be taken to see that the leaf once minced does not come into direct contact with the hands it is necessary to use a small broom made of 'eikel' (about 7″ long) for cleaning the machine of all leaf in the crevices. If this is supplemented with a small cardboard tray, lined with aluminium foil for the collection of leaf during the different operations the risk of extraneous taints is considerably reduced.

The bruising operation commences with the mincing of the leaf, which should as far as possible be of a fixed weight. Two samples can be handled simultaneously in two mincing machines and a further two a few minutes later as soon as the machines are free. A delay in sieving would not be serious enough to effect the comparability of four samples at a time.

The leaf is first weighed in a letter balance of the postal scale type on an aluminium pan (about 10″ × 6″ × 2″ deep), a fixed weight being decided on and minced twice. It is then sifted over the hand sieve and the lumps broken up with the spatula until all the leaf goes through. This operation should not take longer than 10 minutes if the leaf is of a good standard and correctly withered. The presence of coarse leaf, however, will make thorough sifting difficult. There is no alternative then but to discard the fraction that fails to pass through the mesh. Every effort should be made to get the maximum amount of dhool and this can only be done by picking out as much as possible of the tough leaf before mincing.



DRYING CHAMBER WITH SINGLE TRAY



CIRCULAR TRAY SHOWING PARTITIONS FOR 4 INDIVIDUAL BUSH SAMPLES.
THE AREA, NOT REQUIRED, IS COVERED WITH A DETACHABLE PIECE OF FLAT ALUMINIUM.

Fermenting:—The dhool is transferred to a small open box (with an aluminium bottom), about 5″ long, 2″ wide and 1″ deep. Fermenting on open surfaces is not recommended since there is a risk of the samples drying out.

A fixed period should be selected, say between 2 and 3 hours, and maintained for all tests. This is most important in the early stages of selection work. When making the final selection the optimum period might be sought.

Firing:—This presents the only difficulty. A miniature drier is a costly item and will be found wholly unsuitable unless trays can be changed periodically. The rapid moisture testers of the type which functions on a rapid air flow at a high temperature can on no account be recommended. The main disadvantages are:—

(*a*) Most of the leaf on account of its finely divided state is blown off.

(*b*) If steps are taken to prevent this by placing trays with leaf one above the other air flow is restricted, as a result of which the temperature rises rapidly. Though electrically operated, perfect control is difficult even should one sample be fired at a time.

(*c*) The fired tea generally has a roasty and greenish character.

A method that will not be very difficult to adopt on estates is to use the hot air supply from a commercial drier by a duct connected with a small chamber fitted with a single removable tray. The tray should be of very fine mesh not larger than No. 24 and have an area of about 3 square feet. If this is divided by detachable partitions into sections, 6″ × 6″ each, four samples or more could be handled at a single time at say half-hourly intervals. (The diagrams show the layout.) It is most essential that the air-flow should be in a downward direction in order that there might be no 'blow out'. As a precaution against 'fall through' the leaf should first be spread in little trays made of wire mesh of the same size used for the main tray. These are then placed in the sections provided.

The teas may be fired for about 15 minutes at 190°F while the commercial drier is in operation, but it would be preferable whenever possible to work the drier empty at a lower temperature and fire for a longer period.

An alternative method used by some estates is to place the samples in wire cages and suspend them in the duct or below the bottom tray of the drier. Satisfactory results are known to have been obtained.

After drying, the teas should be stored in small sample bottles until required for sifting as they are very liable to go off if unnecessarily exposed.

Sifting:—All dust should be removed by sifting over No. 30 or No. 40 mesh. What is left then for tasting is a sample closely resembling a Fannings grade. The necessity of having the leaf particles of the same size in every sample need hardly be emphasized. Standardization of the grade is just as important as regulating the method of manufacture.

Tasting:—So long as it is remembered that there is a small degree of abnormality in the liquor, a natural consequence from lack of rolling, a tea taster should not find it hard to estimate the cup characters of a tea. Discounting the special strong, harsh character, which is naturally induced by mincing, it is remarkable how small differences in quality could be detected. To ascertain the variations in inherent characteristics with a fair degree of accuracy from the usual type of report given by a tea taster is not easy even if it is decided to choose one sample as a standard for purposes of comparison and manufacture it on every occasion quality tests are done. Some method of systematizing reports is essential and it is recommended

that at least the two main characteristics, colour and quality, be expressed on a basis of marks. A report from of the type shown below will provide all the information needed:—

Sample No.	Colour Marks *	Quality Marks *	RANK A. above average. B. average. C. below average.	Order of merit. First 3 or 4 samples.	REMARKS	
					Infusions	Liquors
General Comments :—						

* Maximum possible—10.

Standardization of manufacture on the lines indicated will enable quality to be assessed without any appreciable error. However, certain factors other than those referred to, have to be taken into consideration as well before it can be concluded that the character of the tea produced from any particular bush is solely intrinsic.

Season:—The season during which a test is made does, without a doubt, influence quality to a great extent. In a study of the properties of various bushes at St. Coombs there have been many instances of 'C' class bushes (below average quality) producing 'A' class teas (above average quality) during periods when extra quality is induced by favourable weather conditions. Accordingly, it is incorrect to presume that a bush is suitable for propagation on the score that its teas are ranked 'A' when it has been tested only during a good quality period.

In fact, the proper time when a bush should be tested is when climatic conditions are unfavourable for the production of good quality and if exceptional quality is noted no doubts can exist as to what has contributed to the result. Still, repeated tests in the same period are necessary to confirm the result. A bush with outstanding quality will be found to give consistently good teas in all seasons.

Age from pruning:—A precaution that must be taken is not to test bushes from a young field or to manufacture flush from shoots allowed to grow for the purpose of taking cuttings. A bush must be in *regular plucking* and at least a year old from pruning (first tipping at high elevations) before tests are contemplated. Failure to observe these rules will make a quality test worthless. It is equally important when comparing different bushes to see that they are all of about the same age from pruning.

Standard of plucking:—The influence of the standard of plucking is too well known to be commented upon. In view of the infinitesimal amount of leaf manufactured, the greatest care should be taken in the plucking, which need not be of too fine a standard so long as some uniformity is maintained. The characteristics of the tea from a single bush are considerably affected by the nature of the pluck and comparison will not be true if the composition of the flush is variable.

Period of fermentation:—Attention has already been drawn to a fixed period of fermentation for the initial tests. It must not be overlooked, however, that owing to the wide variability of the rate of fermentation from bush to bush and the impracticability of altering the bruising tenchnique a fixed period of fermentation might not be advisable for some teas. Optimum quality may in certain circumstances be obtained without sacrificing the other desirable properties of a tea liquor by a suitable adjustment in the period of fermentation.

Accordingly, it is always best to try out various periods before rejecting a bush merely because it might have given an average quality tea. In the case of rapid fermenters, for instance, it was revealed that shortening of the fermentation by about one fourth the normal time generally resulted in an improvement in quality. Another very interesting point of note, observed in the group of rapid fermenters identified, was that those with really poor quality were not in any way improved by a shorter fermentation. *Poor fermenters* on the other hand do not seem to benefit by lengthening the period of fermentation. For bushes of outstanding quality varying the period within reasonable limits made no appreciable difference.

The necessity for a repeated number of manufactures is clearly indicated by what has been discussed so far and this warning is given in view of the current practice on many estates to rely on one or two tests for their conclusions. Twelve consecutive manufactures at monthly intervals should be adequate to judge the prospective value of a clone.

Clonal material:—The method described for individual bush manufactures will be found suitable for clonal material as well and the availability of more leaf will minimize to a great extent some of the errors introduced when handling only a handful of flush from a single plant. The object of quality tests on clones is, as stated earlier, to confirm the results obtained from the mother bush. It is highly desirable that these should be done because of the influence of the numerous factors mentioned.

The maximum amount of leaf that can be comfortably handled by the equipment recommended for individual bush manufacture is 4 ounces of green leaf, equivalent to 1½-2 ounces of withered leaf. A dozen or so bushes should suffice to provide this amount of leaf even during low cropping periods. Generally more plants are put out in the multiplication plots. If the number exceeds 40 advantage should be taken of the extra amount of leaf that would be made available by using a miniature roller instead of the mincing machine. Since teas closely resembling normal manufacture can be produced there will be greater scope for studying the finer characteristics. Nevertheless, it must be stressed that just as in the case of individual bush manufacture, *standardization* is necessary.

A machine with a jacket 6″ in diameter and 6″ in height can take a charge of 1½ to 2 pounds withered leaf. If pressure is carefully adjusted it will be possible to do 3 rolls. Dhools are separated over a hand sieve fitted with No. 6 mesh and finally amalgamated with the big bulk before firing. The same drying tray as that used for individual bush samples will serve for firing if the detachable partitions are removed. (See diagrams). Sifting can proceed on normal lines and by the use of a cutter, a grade of about the size of a small B.O.P. can be obtained for tasting. Here again, it must be emphasized how important it is to standardize all the processes. A larger or smaller outturn of the grade taken, can, for example, alter all the characteristics of the liquor.

Infusion and quality:—The observations made during manufacture have often agreed with a tea-taster's report, particularly as regards 'nose' from the quality stand-point. But it is a mistake to presume that a good colour in the fermenting leaf denotes a good quality tea. At the same time it must not be imagined that a coppery infusion will result from leaf that appears to be fully fermented at the time

of firing. It can be greenish after brewing. It is also incorrect to take for granted that colouy liquors cannot be associated with greenish infusions.

Nearly 2,000 independent tests of hundreds of samples have been done in the past 18 years and it can be definitely stated that there is no relation between the colour of the infusion and the liquoring properties of a tea. If, therefore, ordinary fermentation tests are not followed by an examination of the liquor most misleading inferences may be drawn.

Since infusion plays such an important part in governing the value of the commercial product the following few examples are given to illustrate the disparity that can exist between infusion and quality:—

Bush No. 169 —Above average quality; infusion not very bright and rather greenish.

Bush No. 361 —Fairly bright infusion but very poor quality.

Bush No. 1006 —Quite useful quality but infusion much too green.

Bush No. 1082 —*A very good infusion but disappointing liquor.*

Bush No. 930 —*Excellent quality but commercially out of the running owing to too green an infusion.*

Bush No. 506 —Quite a nice tea but rather different in type; its infusion is poor compared with its quality.

Variations in characteristics:—The considerable variations in the characteristics of the teas tested at the Institute have been astounding. That it is the genetic factor which has contributed to these results is beyond question. Further examples taken at random and given below strikingly convey the variations in the type of tea produced from different bushes:—

Bush No. 884 —Rich liquor with plenty of body; remarkable for its creaming and strength but the *infusion is rather dull.*

Bush No. 896 —Very dull infusion, appears to be manufactured from tippings or the coarser leaves of young tea and lacking in quality and character.

(**Note:**—This bush on one occasion received 4½ marks for colour and 0 *for quality*).

Bush No. 777 —*Bright reddish infusion* with good strength and quality and has a dryness reminiscent of autumnal 'Dooars'.

Bush No. 407 —Tastes like smell of *old fermented tea leaves.* Quality nil.

Bush No. 216 —A typical good Dimbula.

Bush No. 21 —*Exceptional combination of colour with very useful quality.*

Bush No. 1294 —*An excellent tea*, stand out with good flavour.

(**Note:**—These remarks were made when it was manufactured in August in the middle of the S. W. Monsoon).

Bush No. 170 —Unusual characteristic with an unpleasant *sweaty tang.*

The tea of one bush from another estate and manufactured at the Institute received the unusual report of being *overfired.* That was the impression the tea-taster had of the liquor but there was no question of it being over-fired because three other teas fired with this particular sample at the same time and on the same tray under strictly identical conditions were considered quite normal. Another manufactured during June (S.W.Monsoon) with a few others from the same field in St. Coombs estate had a touch of flavour and prompted this question: "*Is this bush subject to more wind than the others?*" Yet another had a *malty character*, while bushes in close proximity gave greenish liquors, one of which was described as *sickly green.*

This list will not be complete if special mention is not made of one particular bush (No. 9), the teas from which did not ferment. The infusion was very green and the liquor thin and green and it was considered a useless tea commercially. Varying the degree of wither and even *extending the period of fermentation to* 24 *hours* failed to ferment it. Normal fermentation was induced only by the addition of an oxidase preparation, yet the infusion did not acquire a coppery hue.

Conclusion:—The results bring home sharply the old saying:—"Tea is made in the field". It is indisputable that the improvement that can be effected in a tea by any method of processing bears no comparison to what can be achieved from the right type of leaf, and all the skill in tea manufacture will not be able to make up for the absence of something which nature has not provided. The predominant influence of the raw material belittles the extravagant claims sometimes made on behalf of any particular manufacturing technique. This significant factor alone should alter one's outlook on manufacture.

It is earnestly hoped, therefore, that this article will not only bring about a common sense approach to tea manufacture, but also stimulate an interest in vegetative propagation. It can be readily perceived without any further proof that the industry can ill afford to continue replanting with doubtful material and that only by careful selection will a teamaker's dream be brought a step nearer to realization.

*SHADE TREES FOR TEA

W. J. Rettie

The value of shade trees in the long-term agricultural policy of a tea estate is widely recognised but it is important that their functions should be equally appreciated before embarking on a rotational system of planting.

To name some of these:—

1. They of course provide shade beneficial to growth in tropical countries.
2. They benefit the permanent crop, in this case tea, provided a balance between protection to the tea and absorption of the soil moisture is maintained.
3. The protection afforded by shade reduces high temperatures destructive of organic matter in the soil.
4. They provide large quantities of green manure, either in the form of loppings or leaf-fall, for maintaining humus and soil fertility.
5. They assist sub-soil aeration by penetrating intractable soils.
6. They protect the tea from sun scorch and hail.
7. They provide a valuable litter for checking loss of soil moisture and erosion. For example, Albizzias much more than dadaps soften the impact of heavy rain by converting it into a fine spray.

There are, however, dangers inherent in the indiscriminate use, or perhaps it should be termed abuse, of shade trees as certain species introduce root disease, or, if improperly handled, accentuate a fungus disease such as blister blight or cause, in the case of *Acacia decurrens*, a leaf disease such as Cercosporella. If left uncontrolled or allowed to grow too large, shade trees also compete with the permanent crop for moisture and nutrients.

Recent experiments in Assam appear to indicate a lower response from nitrogenous fertilisers under heavy shade. Indeed, it is claimed that certain types of tea give little, if any, response under heavy shade, and that results from different types, to nitrogen applied under heavy shade, vary. These experiments are probably of too short duration to provide the final answer.

Experience shows that although well regulated shade is beneficial, excessive shade provided by uncontrolled or too closely spaced trees may be, and generally is, harmful. In the past there has been much evidence in Ceylon of the restrictive effect on crop of excessive shade and lack of response to fertilisers caused by a close stand of old grevilleas or tree legumes although soil structure has been improved and humus built up.

All this emphasizes the need for choice of the right type of tree and correct management. Generally speaking, it may be said that the tree legume that thrives

* The Institute does not necessarily endorse the views expressed in papers contributed by persons other than members of the staff.

best in any given locality is the most suitable provided it is correctly treated. Periodical lopping controls growth and ensures an adequate foliage for green manure purposes as opposed to excessive wood growth in the case of unlopped trees.

Correct spacing and rotational replanting are of vital importance as affecting crop quality and the incidence of fungoid and leaf diseases. It is necessary therefore to adhere to a long-term planting policy.

During the war closer planting of tree legumes was adopted on some estates to compensate partly for the shortage of fertilisers, but when the latter were again available in plentiful supply the stand of trees was reduced to normal. Where however this was delayed for various reasons the original stand of trees became overmature causing excessive shade and limited response from heavier doses of fertilisers owing to competition with the tea. The quality of the teas also suffered.

To quote one example. On an estate in a North East district, where prior to the war the stand of tree legumes was at 24 ft. by 21ft. spacing (*i.e.*, every 6th row of tea and 6th bush in the row, at 4 ft. $\times$ $3\frac{1}{2}$ planting for tea), and of grevilleas at 48 ft. by 42 ft. spacing (*i.e.*, every 12th row of tea and 12th bush in the row), it was decided, owing to rationing of fertilisers, to plant tree legumes at 16 ft. by 14 ft. spacing. Even with frequent control this stand appeared at times to affect quality adversely, although not crop as the trees were young. When ample fertilisers were again available it was decided to revert to the pre-war stand of trees, but a delay in carrying out instructions resulted in trees in many fields becoming over-mature and competing with the tea for moisture and nutrients applied in larger doses. Overshading also accentuated attacks of blister blight causing a further decline in crop and vigour of the bushes. Immediately this was rectified both crop and quality improved. This example serves to emphasise the need for care in planting and vigilant control subsequently.

Various species of tree legumes require different treatment to ensure the best results. For example, there is a tendency to lop, or pollard, Albizzias on the same system as is employed for dadaps and gliricidias.

Apart from other functions it may be said that the green manure value of the Albizzia lies mainly in the constant leaf-fall, not in the loppings, and it is advisable therefore to maintain as large a "head" as possible by initial pollarding of the main stem when the tree has grown to a considerable size and thereafter by occasional pollarding of gormandisers only, not by regular lopping. If over-shading occurs heads can be thinned out not reduced in size. Admittedly Albizzias do not stand up well to wind and here closer planting and smaller heads are advisable.

Where winds are severe Acacias give the best results provided they are controlled by "hair-cutting" at fairly close intervals, and foliage is removed by this method at the beginning of the monsoon to minimise danger of attacks of Cercosporella. Much damage is done on estates by indiscriminate, premature and careless lopping of shade trees, often to the extent of causing actual casualties.

It seems unnecessary to emphasise the need for establishing a uniform stand of trees and for early replacement of failures, yet an irregular stand is more often the rule than the exception on estates. In this connection. Dr. Haworth's article in the *Tea Quarterly* of December 1952, would repay close study.

As one authority, Dr. T. Eden, has pointed out, "the continued fertility of soil in tea districts of old standing in Ceylon is rightly attributable to the presence of shade trees properly used, controlled and replaced at reasonably close intervals."

Tree Legumes & Grevilleas (Rotational Replanting)— Pro Forma Statement

Notes: G = Grevilleas, A = Albizzias, D = Dadaps — Original planting in bold type

Tea spacing, 4 ft. by 3½ ft.

Entries in *italics* show lines to be replanted.

Renewal Periods (which may be modified for local conditions).

Grevilleas say 12 years, establish new stand 6 years after original planting.

Albizzias say 8 years, establish new stand 4 years after original planting.

Dadaps say 8 years, establish new stand 4 years after original planting.

Tea Rows

Bushes in Rows	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1	**G**								*G*								**G**								*G*								**G**
2							**A**								*A*								**A**								*A*		
3																																	
4												**D**								*D*								**D**					
5																																	
6																																	
7																																	
8							**A**								*A*								**A**								*A*		
9	**G**								*G*								**G**								*G*								G
10												**D**								*D*								**D**					
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The diagram following this article sets out one system of spacing and rotational replanting suitable for estates at a normal elevation in a South West district up country. There are, of course, other systems.

The system illustrated aims at rows of shade trees in various stages of maturity. Thinning out is best done by the removal of rows, not individual trees which become over-mature in the rows. Felling and removal immediately prior to pruning should be preceded by ringbarking, except under special circumstances.

In North East districts, subject to long dry spells, slightly closer spacing is advisable, and the advantage of having alternate rows of Albizzias and Dadaps is that during drought periods the latter tend to suffer defoliation whereas the former do not. A light, nicely diffused shade has advantages during dry spells.

Some species of tree legumes are notoriously moisture robbers and effective control during droughts is important. The subject of bush legumes and cover crops generally is not dealt with in this article although these make an important contribution to green manuring, soil improvement and conservation in any long-term cultivation policy.

A NOTE ON LIME WASHING

E. S. Rose

In the annual report for 1950, *page* 37, *the Plant Physiologist reported favourable results with lime spraying for the control of mosses and lichen on pruned bushes. Emphasis was laid on the necessity for a good grade of lime suitable for spraying. During the past two or three years the practice of lime washing has grown considerably, but most estates find that local lime is not suitable for spraying, and have experienced much difficulty in the application of the wash.*

Accordingly, enquiries revealed that Messrs. Imperial Chemical Industries (Export) Ltd., stocked an imported lime called "Limbux" Hydrated Lime. The analysis figures provided an indication of the high quality of this product. A comparable analysis of local lime was then made and fully confirmed the extremely poor quality of the local product.

Analysis:	"Limbux"	Local Lime
Calcium hydroxide	96.84%	41.60%
Calcium carbonate	1.02%	36.69%
Magnesium hydroxide	0.44%	1.87%

The grading of the local lime indicated its total unsuitability for spraying even with coarse lime washing nozzles.

Grading:	"Limbux"	Local Lime
Passing 30 mesh	100%	26%
„ 52 „	100%	1% (approximately)
„ 100 „	99.05%	
„ 150 „	97.02%	
„ 200 „	94.02%	

Trials carried out by the Superintendent of St. Coombs Estate, reported in the following article, confirmed the apparent advantages of using high grade lime. It should be stressed that the standard of work with the high grade material was greatly superior to that achieved with the miserably poor material used previously.

Since this trial was carried out, a case of severe damage due to the application of partly slaked lime has occurred. Some of the half-burnt coarse, gritty lumps in the local product slake very slowly, and if applied in a partly slaked condition will damage the bark of tea bushes to which it is applied.

Many estates are now adopting a much lighter type of pruning with little or no cleaning out from the centre of the bush, and in consequence it is becoming difficult to remove the accumulation of moss and lichen, particularly from bushes where the branches are numerous, but small. These increasing difficulties are causing corresponding increases in cost with possibly lower standards of work. Lime-washing has proved to be the easiest method of dealing with the problem.

In the past, on St. Coombs, lime from local sources has been used, but this year it was decided to try an imported product. A field of 17½ acres was divided into two plots of 8½ and 9 acres, to be lime-washed with local lime and imported lime respectively.

The local product was applied first to $8\frac{1}{2}$ acres using normal "Four Oaks" spray equipment fitted with non-clogging lime spraying nozzles, at an application rate of 4 cwt. lime to 100 gallons of water per acre. The knapsacks were charged, using a hand charge pump, to 40 lbs. air pressure with 75 lbs. total pressure, and it was found that it took 15 minutes, approximately, to charge this amount and, using 5 knapsack sprayers, 12 charges per acre were required. Two drums were used for mixing purposes, a small capacity container for mixing into paste and a 25 gallon half oil drum for the final solution, *i.e.*, one cwt. lime per 25 gallons water.

It was apparent that the lime had not been slaked satisfactorily and slaking continued for some time after the mixing was complete. All the lime was passed through a 50 mesh filter to remove insoluble material such as sand and coral.

35 cwts. of lime were used for the $8\frac{1}{2}$ acres, one extra hundred weight having to be applied to obtain satisfactory cover, and from these 35 cwts. an amount in bulk, not by weight, of approximately 13 one hundred weight sacks of waste sand and coral were removed.

The cover obtained with this mixture was adequate, but very uneven, due mainly to continual blockages. Not only were the nozzles blocked but, on several occasions, the whole lance became filled with lime and caused considerable trouble and delay before work could continue.

The weather during application was not ideal, monsoon rain being experienced most of the time and a considerable amount of the lime was washed from the bushes. An adjacent plot of 9 acres was then sprayed with imported lime, using the same equipment, at an application rate of between $1\frac{1}{2}$ and 2 cwts. of lime in 100 gallons of water per acre.

It will be seen from the analysis and grading that this is a good quality lime and, what is more important, very finely graded enabling all the lime to pass through the nozzles without blockages. This lime was mixed in the same way as the local product at first, using 2 drums but later it was found that only 1×25 gallons drum was adequate.

It was naturally not necessary to filter the mixture before use and no wastage occurred. An application rate of $1\frac{1}{2}$ - 2 cwts. per acre was found to be adequate and in fact, it was possible to reduce this to 1 cwt. per acre where the moss was only slight.

The knapsacks were charged to only 30 lbs. air pressure up to 75 lbs. total pressure—a slight reduction in air pressure being more economical. The cover obtained was very even and the lime appeared to have good adhesive properties since even after heavy rain it was still apparent on the bushes.

The following table gives comparative costs for both types of lime:—

Lime from Local Sources

Total lime used on $8\frac{1}{2}$ acres	Total Cost	Cost per acre on $8\frac{1}{2}$ acres
35 cwts. at Rs. 7/-	Rs. 245.00	Rs. 28.82
Transport on above	20.01	2.35
	Rs. 265.01	Rs. 31.17
$8\frac{1}{2}$ acres at 7.29 labourers per acre = 62 labourers (cost per labourer = Rs. 2.22 plus 0.25 cents excess rate on spraying	Rs. 153.14	18.01
	Rs. 418.15	49.18

Imported Lime

Total lime used on 9 acres	Total cost	Cost per acre on 9 acres
34 × 56 lbs. at Rs. 7/90*	Rs. 268.60	Rs. 29.84
Transport on above	30.17	3.35
	Rs. 298.77	Rs. 33.19
9 acres at 5.89 labourers per acre = 53 labourers (cost per labourer Rs. 2.22 plus 0.25 cents excess rate on spraying)	130.91	14.55
	Rs. 429.68	47.74

It will be seen from these figures that, despite the higher cost per cwt. of imported lime, the overall cost per acre is less due to a saving of 1.4 labourers per acre, or Rs. 3/46.

To sum up, all the operations involved were easier with imported, good quality lime, the application was better and the cost smaller.

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* Price September 1953, now reduced to Rs. 7/50.

A NOTE ON SPRAYING AND DUSTING AGAINST BLISTER BLIGHT

C. A. Loos

In a recent article on "Dusting and Spraying against Blister Blight on Ury Group" (*Tea Quarterly*, Vol. XXIV, Part 3, September, 1953, pp. 70-75) the price quoted for "Cuprosana" 4 per cent copper fungicidal dust was the price in operation during the period under review. It has been recently brought to our notice that from 1st October, 1953, this formulation has been sold at 35.6 cts. per pound f.o.r. Colombo.

The representative in Ceylon of Messrs. Universal Crop Protection, Ltd., the manufacturers of "Cuprosana" dusts, states in a communication to this Institute that in 1952, under weather conditions prevailing during the period of our own spraying and dusting experiment on Ury Group, some estates in the Uva district obtained adequate protection against blister blight, on tea in plucking, from applications of 5-6 pounds of 4 per cent "Cuprosana" every 8-10 days. In such cases one application was required between pluckings.

We have also been informed by a few representatives of agencies distributing copper fungicidal sprays that under the same conditions 2-3 ounces (instead of the recommended 4 ounces) of wettable 50 per cent copper formulations in 10 gallons water gave adequate protection against blister blight.

In reviewing my recent publication I have to state that recent developments in spray applications have reduced spraying costs from between Rs. 2/75 and Rs. 3/- at the time of the Ury experiment, to approximately Rs. 1/70 per acre at the present time. The designer of the "Hobson" Boom is hopeful that with this apparatus the "running" cost of spraying, including fungicide, will be brought within the region of Rs. 1/25 per acre.

The amounts of wettable powders (sprays) and dusts we have recommended for the control of blister blight are maximum amounts for adequate protection under all possible weather conditions. The efficacy of amounts below our recommendations would depend on strictly local conditions and can best be judged by the man on the spot. Thus the decision to use, on any estate, lower concentrations than we have recommended must necessarily lie with the management concerned.

THE MECHANISATION OF THE FARM

S. J. Wright

In this article, which we reproduce by arrangement with "London Calling", the Overseas Journal of the B.B.C., Mr. Wright, Consultant on engineering to the Royal Agricultural Society of England, outlines the remarkable progress that has taken place in farm mechanisation in Britain during the past few years, thanks to a new agricultural engineering trade and the motor industry.

Mr. Wright, it will be remembered, visited Ceylon under the Colombo Plan earlier this year to report on the possibilities of mechanising tea cultivation in the island.

One outcome of the war has been a quite staggering increase in the use and manufacture of farm machinery in Britain. We now use seven times as many tractors as we did in 1938, and manufacture fifteen times as many. Again, of the items of farm equipment that are now numerous enough to be worth listing separately in our biennial farm-machinery census, more than a third were not in existence at all, or had scarcely been heard of, when the first census was taken only fifteen years ago—I mean things like mounted ploughs, disc-harrows, potato-harvesters, self-tying balers, dung-loaders, sugar-beet toppers, and a host of others in a list that grows longer and more varied every year.

But figures are meaningless unless you have some mental picture of the position from which we started just before the war. We had, of course, already experienced the main consequences of the Industrial Revolution. Our ploughs and everyday tools were made from iron in factories, instead of being made from wood by village craftsmen. We no longer cut or threshed or winnowed any of our corn crops by hand. We had sixty or seventy years' experience of the use of steam power for heavy, large-scale cultivation, and had seen it superseded by the internal-combustion engine.

But corn was still stooked and stacked, and root crops harvested entirely by hand ; while all but a small fraction of our motive power was still provided by horses. And although tractors and modern equipment were common enough on large farms, the great mass of smaller ones—of less than, say, 250 acres—had virtually no experience at all either of tractors or of any machine more modern than the reaper-binder. But today, I suppose, something like eighty per cent. of all our farm power is provided by tractors or by stationary engines; while, if there is any longer a lower limit to the size of farm than can be mechanised, I doubt if one could put it higher than twenty-five acres or so.

The changes that have taken place over the same period in our farm-machinery industry are, in some ways, more remarkable still. Before the war we met most of our needs for everyday equipment—ordinary tractors, ploughs, mowers, and so on—and we sent a fair number of these things to other countries as well. But any special tractors that were needed—like track-layers, or models adapted to inter-row cultivation—and all the more modern appliances like harvester-threshers, pick-up balers, and combined seed and fertiliser drills with which our larger farms were being mechanised, had to be brought from overseas. Moreover, although our agricultural-engineering industry was well-established—and, perhaps, because it was so long-established—it lived quite apart from our main engineering industries. It was located in a different part of the country had quite different standards, and used quite different manufacturing methods.

The mechanical plough—a development of the mounted implement which has made small-scale farm mechanisation practicable.

A pick-up baler. Before the war Britain had to import appliances of this sort. Today she is able to export them.

In Great Britain tractors or stationary engines now provide eighty per cent. of all farm power.

Indeed, at that time, even if one had known nothing of either agriculture or engineering it would have been easy enough to pick the one agricultural machine out of 100 non-agricultural ones, just because it looked different—in much the same way as a farm looks different from a factory. But one would have quite a job today to pick out an agricultural machine simply by its appearance, or even by a close examination of how it had been made. And that is because our old industry works no longer in isolation but in very close partnership with the younger motor industry.

Development of the Mounted Implement

This new partnership—indeed one might almost call it a marriage—between two industries has been brought about mainly by the development of the mounted implement: the implement that is mounted on, or closely coupled to, the tractor, instead of just being pulled along by it. And if one new development more than any other has made small-scale farm mechanisation practicable, I suppose it is this same mounted implement.

But to go back to the manufacturing side: it was natural enough for farm tractors to be made by the same firms who made motor-cars and trucks, because so many components—from engine to transmission—were common to both. Until quite recently, however, most of our tractor makers were content to leave it at that, and to let someone else make the implements in his own way and according to his own ideas. But when, as the result of the new development, tractor and implement became virtually one unit, neither party could afford any longer to work in isolation from the other.

Either of them might, of course, have tried to take over the other's job. What has actually happened is a very happy and effective combination, in which all the inherited experience and tradition of the one industry has been joined to the manufacturing skill and productive capacity of the other. And perhaps, it is by production figures that the outcome can most simply be illustrated.

In 1938 the two industries, working as they then did almost independently of one another, produced tractors and farm machines worth just over £3,000,000. In 1950, working in combination, production was worth nearly £85,000,000, and not only satisfied all the needs of our own farming but produced twice as much more to meet farming needs in other countries. Nor are they just producing greater numbers of the same things as before. Between them they have improved most of our older implements out of all recognition; they have adopted and adapted all those that we used to import; and they developed a good many that are entirely new in purpose and conception.

This wave of mechanisation and new development all arose, in the first instance, from our own urgent wartime need to grow at home more of the food, that we had imported until then. We had to plough up vast, new areas—either grassland that would be more immediately productive in arable cultivation, or marginal land that was nearly derelict.

The only way to get the job done quickly enough to save ourselves from starvation was to step up the production of tractors and tractor implements; and, through Government agencies, to find means of making their services available even to small-scale farmers who could not afford to buy them for themselves. By this means we added more than five million acres to our tillage area in less than four years, and brought about generally higher crop yields at the same time. Moreover, by the end of the war many more farmers could afford to buy equipment as the result of higher and more profitable production in the meantime.

Our need to grow more food at home is just as great as it was then. But we have an additional purpose that is worth mentioning; to raise output per man at the same time. For this is the only way in which we can afford to give our rural population the higher wages and better living conditions that will keep them in the countryside.

Applying the Same Solutions in Asia

I should like now to refer specifically to Asia, where even a twenty-five-acre farm is likely to be an outstandingly large one. I think everyone would agree that, when it comes to the details, the difficulties there are much greater than in Britain. Yet I feel that, in principle, the problems are much the same and that, in principle, they call for much the same kind of solution. For all Eastern countries alike need to grow more agricultural produce, either to feed their own ever-growing populations or to exchange for all the other commodities that they want to import.

In all of them, too, there is an evident need to raise the standard of living of the peasant-cultivator. And, in any mainly rural community, the one factor above all others that will control living standards is the amount of human effort in man-hours or man-days that it takes to grow one ton of crop. To increase both total production and production per man is, indeed, the only ultimate solution.

My views on all this are probably coloured by the fact that, having been actively engaged for over twenty years in the study and development of farm mechanisation under Western conditions, I had my first look at Eastern farming only in 1949. I have paid three visits since—to Pakistan, India, and Ceylon—and I think just one example will illustrate my point. In India I saw powerful, track-laying tractors being used to reclaim land that had gone derelict through becoming infested with *hariali* or *khans* or some other deep-rooting weed. They were Government tractors, of course, and the work was being done as just one item in a nation-wide campaign to grow more food.

I was told that there were some millions of acres of similarly derelict land still to be tackled: that all that was required was deep and thorough ploughing at the right time of year; and that if this had been done periodically while the land was still in cultivation it would never have gone derelict in the first place. Nearby I saw at work the iron ploughs, drawn by up to eight bullocks, with which the ordinary cultivator strives to keep his own land from weed-infestation; while here, there and everywhere I saw the wooden scratch plough, drawn by a single pair of bullocks, with which, I suppose, more than ninety per cent. of all Eastern cultivations are done.

Incidentally, it is worth mentioning that both the iron bullock plough and the massive ploughs behind the track-layers bore, as trade mark, the name of the Englishman who contrived the very first all-iron plough more than 150 years ago. The iron plough was doing a perfectly satisfactory job, and if the same had been done regularly over the whole area there would have been no need for the track-layers. Indeed, the only trouble with it—and the only reason why ploughs like it had not kept the derelict land in cultivation—was that it took twelve man-days and twenty-four bullock-days to plough an acre.

I believe that the main clue to the West's greater progress in the development of both better implements and better cultivation is to be found in the simple fact that, in a more temperate climate, it was easier to develop better draught animals: first better oxen and, later, still better horses. And if I am right this, at least, is one disadvantage of climate that Asia need labour under no longer. Mechanical power takes no account of heat or drought or disease; and to find means of applying it to Asia's difficulties is one of the most worth-while objectives that agricultural engineers have yet been given.

MINUTES OF THE MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD AT THE OFFICES OF THE PLANTERS' ASSOCIATION OF CEYLON, 113, STEUART PLACE, COLOMBO, ON FRIDAY, 17TH JULY, 1953 AT 2-30 P.M.

Present.—Mr. R. C. Scott, C.B.E. (in the Chair), Messrs. H. S. Hurst, B. C. V. Weeks, G. K. Newton, W. H. Attfield, W. Neal de Alwis, J.P., U.M., Errol Jayawickreme, J.P., U.M., D. E. Hettiarachchi, J. P., U. M. A. D. McLeod, W. R. Vander Kiste, C. Dymoke Green, Dr. A. W. R. Joachim, M.B.E. and J. Lamb (Secretary).

1. Notice convening the meeting was read.

A letter regretting inability to be present had been received from Mr. V. G. W. Ratnayake, M.B.E., M.P.

2. **Minutes of the Meeting of the Board held on 1st April, 1953**

The minutes were confirmed.

3. **Membership of the Board & Committees**

(a) **Board.** The Chairman welcomed Mr. B. C. V. Weeks to his first meeting of the Board.

(b) **Estate & Experimental Sub-Committee.** It was reported that:—

(i) Mr. B. C. V. Weeks had consented to serve on this Committee during Mr. A. J. Dickson's absence.

(ii) Mr. A. S. Hudson had consented to serve in place of Mr. R. Leaning during the latter's absence on leave.

(iii) Mr. S. P. Vytilingam had left the Island on long leave.

(iv) The Committee had recommended that all members of the Senior Staff of the Institute should be made members of this Committee. Formerly, members of the senior staff with the exception of the Director, Convener, and Superintendent St. Coombs were present only on invitation.

4. **Minutes of the Meeting of the Estate & Experimental Sub-Committee held on 19th April, 1953**

The Chairman asked the Board to agree to an expression of thanks to the Directors of the Eastern Produce & Estates Co., Ltd. coupled with the names of Mr. Rettie and Mr. Andrews, for having placed at the Institute's disposal 648 acres on Meddecombra estate for large scale spraying and dusting experiments.

36/TRC.

5. **St. Coombs Estate**

(a) **Superintendent—Mr. E. S. Rose.**

The Chairman reported that Mr. E. S. Rose had assumed duties as Superintendent of St. Coombs Estate on the 15th April, 1953, relieving Mr. B. D. Garnier who had acted from 1st March.

(b) **Visiting Agent's Report dated 24th April, 1953.**

This report was accepted by the Board. It was reported that Mr. Newton had again visited St. Coombs Estate on the 10th July, 1953. Mr. Newton stated that his report was ready for despatch.

6. **Tea Research Cess**

Letters from the Planters' Association of Ceylon, Agency Section; the Low-Country Products Association and the Ceylon Association in London, supporting the Institute's application for an increase in the cess were read. The Director stated that copies of these letters had been sent to the Minister for Agriculture & Food.

7. **Staff**

(a) **Engineer—Mr. J. Landreth.** Reported that Mr. Landreth had resumed duties on 11th May, 1953.

(b) **Assistant Pathologist—Mr. G. D. Austin.** A letter conveying the formal notice of Mr. Austin's intention to retire on 31st December, 1953, was read by the Director.

8. **Any Other Business**

Small Holdings Advisory Service. It was reported that the head-quarters of this service were transferred to 140, Ambegamuwa Road, Gampola, as from the 1st of June, 1953.

The following confirmation of appointments, recommended by a meeting of the Small Holdings Advisory Service Sub-Committee held on the morning of 17th July, 1953, were approved:—

(i) Mr. T. B. Ratnayake as from 24th May, 1953.

(ii) Mr. L. Vincent as from 1st June, 1953.

J. LAMB,

Secretary.

Tea Research Institute of Ceylon,
St. Coombs,
Talawakelle.

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